

## Lehigh University Lehigh Preserve

---

Fritz Laboratory Reports

Civil and Environmental Engineering

---

1958

# Torsion test manual

Fritz Lab

Follow this and additional works at: <http://preserve.lehigh.edu/engr-civil-environmental-fritz-lab-reports>

---

### Recommended Citation

Fritz Lab, "Torsion test manual" (1958). *Fritz Laboratory Reports*. Paper 1595.  
<http://preserve.lehigh.edu/engr-civil-environmental-fritz-lab-reports/1595>

This Technical Report is brought to you for free and open access by the Civil and Environmental Engineering at Lehigh Preserve. It has been accepted for inclusion in Fritz Laboratory Reports by an authorized administrator of Lehigh Preserve. For more information, please contact [preserve@lehigh.edu](mailto:preserve@lehigh.edu).

**TORSION TEST MANUAL**

**---USING THE 2,000,000 POUND-INCH  
TORSION TESTING MACHINE---**

**August 6, 1958**

**Fritz Lab Report No. 237-10**

**Fritz Engineering Laboratory  
LEHIGH UNIVERSITY  
Bethlehem, Pa.**

## CONTENTS

	<u>Page</u>
I. Designation of Test Specimens. . . . .	2
II. Preparation of the Specimens . . . . .	3
III. Set-up of the Specimens on the Machine . . . . .	4
IV. Operation of the Machine. . . . .	5
V. Change of the Rope Socket Positions when Total Angle of Twist $>30^{\circ}$ . . . . .	7
VI. Level Bar Readings . . . . .	8
VII. Whittemore Gage Readings. . . . .	9
VIII. Routine Test Procedures . . . . .	10
IX. Preparation Before Test . . . . .	11
Additional Recommendations in the Use of the 2,000,000 inch-pound Torsion Machine . . . . .	12

DESIGNATION OF TEST SPECIMENS

P-1 ..... Single plate, no holes  
P-2 ..... Single plate with holes  
P-3 ..... 4 plates  
T-1 ..... 20" girder, no cover plate, bolted and riveted  
T-2 ..... 20" girder, 1 cover plate, bolted and riveted  
T-3 ..... 20" girder, 2 cover plates, bolted  
T-4 ..... 20" girder, 2 cover plates, riveted  
T-5 ..... 20" girder, 3 cover plates, bolted and riveted  
T-6 ..... 50" girder, bolted and riveted  
T-7 ..... 20" girder, welded  
T-8 ..... 50" girder, welded  
T-9 ..... 20" rolled section

PREPARATION OF THE SPECIMENS

- (1) Mount the SR4 gages on the specimen according to the sketch. The Baldwin instructions should be strictly followed.
- (2) Weld-on the level bar seats according to sketch. The vertical post of the seats must be perpendicular to the longitudinal axis of the specimen.
- (3) Drill holes for Whittemore gages:
  - i) The holes should be approximately 0.05 in. in diameter and normal to the gage line and to the surface of the specimen.
  - ii) The holes should be of sufficient depth to leave clearance below the conical point of the leg of the gage and they should be carefully reamed to remove small irregularities in their surface. (Use #54 drill)
  - iii) The holes should be carefully spaced so as to remain well within the working range of the instruments.
- (4) White wash if desired.
- (5) Prepare the fixture plates.

SET-UP OF THE SPECIMENS ON THE MACHINE

- (1) Choose proper torquemeter

Torquemeter A	0	2,000,000 Pound-inch
Torquemeter B	0	500,000 Pound-inch
Torquemeter C	0	100,000 Pound-inch

- (2) Lock the trolley in position according to the length of the specimen. When 2 positions are possible, always use the one which gives more allowance for specimen shortening.
- (3) Move the travelling head of the Riehle Machine (RN) to the top position with 1/8" clearance. Fix the two rope sockets in positions and turn the large wheel in counterclockwise direction until:
- i) the rotating head is approximately in a horizontal position with the south side slightly higher.
  - ii) the rope is tight.
  - iii) we can insert all 3 pins to lock the wheel in position.
- (4) Bolt the 2 fixture plates on the rotating head and the stationary head respectively.
- (5) Set up the specimen carefully, making sure to avoid any externally applied load.
- (6) Properly fit the fixture plates at both ends. Use shim plates if necessary.
- (7) Attach dial gages between the trolley and the stationary head to measure the shortening of the specimen under twist.
- (8) Wiring of SR4 gages.

# OPERATION OF THE MACHINE

- (1) Be sure that the specimen is under no torque. Set the scale of the Riehle Machine (RN) to register zero and take readings of the torquemeter, strain gages, level bars, dial gages and extensometers.
- (2) Be sure that the rope is in a center position on the large wheel and all the 6 pulleys.
- (3) Remove the hand-wheel and turn on the switch if the driving motor will be used as stated in (5).
- (4) Pull out all 3 pins. (Jack may be used on the wheel or a small load applied to ease the pull).
- (5) Apply the load using either the hand-wheel or the driving motor at slow gear (west position) after all three pins are taken out,

1) Using hand-wheel for small increment of load.

ii) Using driving motor

TOP BUTTON (FORWARD)	HEAD MOVES DOWN APPLYING LOAD
MIDDLE BUTTON (REVERSE)	HEAD MOVES UP RELEASING LOAD
BOTTOM BUTTON (STOP)	STOP

iii) Keep the arm of the RN scale either in floating balance or touching the bottom of the end opening. It is on dangerous side for the arm to come in contact with top of the end opening.

- (6) Although slow gear is preferred in most cases, sometimes fast gear (East position) is required for unloading or rapid loading. For one stroke on the Riehle Machine, the slow gear takes 1-1/2 hrs. while the fast gear takes only 20 minutes. When changing the gears, the clutch should be disconnected first.

- (7) Take the following readings for each corresponding load:

1) Torquemeter readings setting first the gage factors and correct compensating gage switches.

ii) SR4 readings setting first the gage factors and correct compensating gage switches.

iii) Level bar readings.

iv) Whittimore gage readings.

v) Dial gage readings.

- (8) Use smaller increment of load for the first few readings. When the load approaches the yield strength of the specimen, smaller increment must be used again.
- (9) The load applied on the RM should never exceed 45,000 lbs. (50,000 lbs. in exceptional cases.)



CHANGE OF ROPE SOCKET POSITIONS WHEN TOTAL  
ANGLE OF TWIST >30°

- (1) At the end of each stroke of the Riehle Machine (RM), insert the three pins whenever possible to lock the large wheel in position. Take all readings immediately.
- (2) Move the travelling head of the RM to the top position with 1/8" clearance.
- (3) Move the south-side sockets one spacing up and then, move the north-side socket one space down thus stretching the rope.
- (4) Pull out all 3 pins (apply small load to ease the pull).
- (5) Apply the load to the last previous magnitude and take all the readings again.
- (6) Twist 30° more.

TAKING THE LEVEL BAR READINGS

- (1) Check the alignment of the level bar seat.
- (2) Apply a small load to eliminate the loose play factor of the specimen.
- (3) Make the top plate of the level bar seat (LBS) level, or vertical, by setting the micro-reading to .515 for horizontal level bar and .425 for vertical level bar respectively.
- (4) When taking a reading, the point of the stationary leg should coincide with the small drill. The point of the micrometer should coincide with the bottom line of the slot. Keep the level bar in a vertical position always.
- (5) Before the level bar is out of range, turn the top piece of the LBS to a level position. Be sure to take the level bar readings at the same load before and after the turning.
- (6) Take 2 independent readings for each point at each load.

WHITTEMORE GAGE READINGS

- (1) Three independent readings for each gage line at each load are required. No 2 readings over the same gage line should be taken successively as the operator is unconsciously prejudiced in estimating the last place of reading.
- (2) The instrument should have the points perfectly clean of grit, etc. at all times.
- (3) All sets of readings should have at least 1 out of every 25 as a check on the standard bar.
- (4) All gage holes should be perfectly clean.
- (5) All sets of observations should have a temperature record accompanying it.
- (6) Keep dial plunger clean at all times.
- (7) Be sure that the instrument is "unlocked" when taking the readings.

Strain: If  $R-R = 1000$   
Strain = 0.001



PREPARATION BEFORE TEST

- (0) White wash
- (1) Measure c. c. Level bars
- (2) Pull out 3 end pins
- (3) Connect strain gage wires and torquemeter box
- (4) Take torquemeter box readings for zero load and adjust Riehle scale
- (5) Fillers and shims at both ends
- (6) Attach dials
- (7) First try-out test in elastic range and field curve

F-4

ADDITIONAL RECOMMENDATIONS IN THE USE OF THE  
2,000,000 inch-pound TORSION MACHINE  
IN  
FRITZ LAB

These additional recommendations are mainly aimed to the operation of the RIEHLE MACHINE and the locking operations of the driving wheel.

1. It is not necessary to start with the rotating head approximately horizontal with the west side slightly higher. Any position of this head is acceptable.
2. It is very difficult to insert all 3 pins to lock the driving or rotating wheel, so, depending on the amount of torque to be kept for another stroke, it is possible to maintain the wheel in locking position with just one pin, or two of them.
3. In order to get full stroke of the RIEHLE MACHINE (R. M.), set up first the specimen and then tighten the rope moving its west end (the one that goes down by its own weight).
4. The full stroke needs to turn the wheel 30° and therefore two sets of holes pass the locking position. In order to avoid over-running of stroke and the necessity of reverse motion of unloading, yellow arrows have been painted on the R. M. to show in an approximate amount, the stroke used, and the remaining to lock the wheel and reset gages, troptometer, belt, etc.

M. A. Macias  
1/27/61